Electronic Version
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Claims

[c1] 1. A method of fabricating a photodiode, comprising the steps of:
providing a substrate;
forming a well region of a first conductive type in the substrate;
forming an isolation structure in the substrate to define a photosensitive area on the substrate;
forming a plurality of trenches in the well region of the substrate within the photosensitive area; and
forming a doped layer of a second conductive type over the substrate, wherein the doped layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area.

[c2] 2. The method of claim 1, wherein after the step of forming the doped layer over the substrate, further comprises performing an annealing operation.

[c3] 3. The method of claim 2, wherein the annealing operation drives the dopants within the doped layer of the second conductive type into the substrate and makes junction of the first conductive type and the second conductive type shift into the substrate.

[c4] 4. The method of claim 1, wherein the first conductive type is P-type and the second conductive type is N- type.

[c5] 5. The method of claim 1, wherein the first conductive type is N-type and the second conductive type is P-type.

[c6] 6. The method of claim 1, wherein the step of forming the doped layer comprises performing a chemical vapor deposition process.

[c7] 7. The method of claim 1, wherein material constituting the doped layer is selected from the group consisting of doped polysilicon and doped epitaxial silicon.

[c8] 8. The method of claim 1, wherein the doped layer completely fills the trenches.

[c9] 9. The method of claim 1, wherein the method further comprises forming a buffer layer over the substrate covering the interior walls of the trenches as well as the surface of the substrate within the photosensitive area after forming the trenches in the substrate within the photosensitive area.

[c10] 10. The method of claim 9, wherein the step of forming the buffer layer comprises performing a chemical vapor deposition process.

[c11] 11. The method of claim 9, wherein material constituting the buffer layer is selected from the group consisting of polysilicon and epitaxial silicon.

[c12] 12. The method of claim 9, wherein after forming the doped layer over the substrate further comprises performing an annealing operation.

[c13] 13. The method of claim 12, wherein the annealing operation drives the dopants within the doped layer into the buffer layer so that a junction of the second conductive type and the first conductive type is formed within the buffer layer.

[c14] 14. The method of claim 12, wherein the annealing operation drives the dopants within the doped layer into the substrate so that a junction of the second conductive type and the first conductive type is formed within the substrate.

[c15] 15. The method of claim 9, wherein the doped layer completely fills the trenches.

[c16] 16. A method of fabricating a photodiode, comprising the steps of:
providing a substrate;
forming a well region of a first conductive type in the substrate;

forming an isolation structure in the well region of the substrate to define a photosensitive area on the substrate;

forming a plurality of trenches in the substrate within the photosensitive area;

forming a buffer layer over the substrate, wherein the buffer layer covers the interior walls of the trenches and the surface of the substrate within the photosensitive area;

forming a doped layer of a second conductive type over the buffer layer; and

performing an annealing operation to drive dopants within the doped layer into the buffer layer and form a junction of the second conductive type and the first conductive type within the buffer layer.

[c17] 17. The method of claim 16, wherein the step of forming the doped layer comprises performing a chemical vapor deposition process.

[c18] 18. The method of claim 16, wherein material constituting the doped layer is selected from the group consisting of doped polysilicon and doped epitaxial silicon.

[c19] 19. The method of claim 16, wherein the step of forming the buffer layer further comprises performing a chemical vapor deposition process.

[c20] 20. The method of claim 16, wherein material constituting the buffer layer is selected from the group consisting of polysilicon and epitaxial silicon.